

IN THE CLAIMS:

- 1 1. (CURRENTLY AMENDED) A method for a particular file server to allocate a spare
2 disk to replace a failed disk in a network storage system comprising the steps of:
3 identifying a set of spare disks, the set of spare disks attached to a plurality of ~~fil-~~
4 ~~ers~~ file servers of the network storage system;
5 choosing a best spare disk of the set of spare disks, the best spare disk attached to
6 any of the file servers ~~filers~~ of the plurality of ~~filers~~ file servers, the best spare disk cho-
7 sen according to a plurality of user-selectable policies; and
8 claiming ownership of the best spare disk.
- 1 2. (ORIGINAL) The method of claim 1 further comprising the steps of:
2 choosing, in response to a failure of the step of claiming ownership, a next best
3 spare disk of the spare disks available; and
4 claiming ownership of the next best spare disk.
- 1 3. (ORIGINAL) The method of claim 2, wherein the step of claiming ownership of the
2 best spare disk further comprises the steps of:
3 setting a first ownership attribute to a file server-owned state; and
4 setting a second ownership attribute to a file server-owned state.
- 1 4. (CURRENTLY AMENDED) The method of claim 1 wherein the step of choosing the
2 best spare disk further comprises the steps of:
3 selecting one or more disks from the set of spare disks that satisfy one or more
4 hard-coded rules;
5 sorting the one or more disks selected from the set of spare disks according to the
6 plurality of user-selectable a-set-of-ordered-policies to identify a highest-ranked disk;
7 choosing a highest-ranked disk as the best spare disk; and

8 choosing, in response to more than one of the one or more disks being highest-
9 ranked, one disk at random, from the more than one of the one or more disks that are
10 highest-ranked, as the best spare disk.

1 5. (CURRENTLY AMENDED) A method of verifying that a plurality of disks in a vol-
2 ume are optimally configured comprising the steps of:

3 identifying all of the disks in the volume;
4 obtaining disk characteristics, respectfully, from all of the disks in the volume;
5 comparing the disk characteristics with a set of policies and characteristics of
6 spare disks; and
7 alerting an administrator if a more optimal configuration of which disks are used
8 in the volume and which disks are spare is possible.

1 6. (CURRENTLY AMENDED) The method of claim 5 further comprising the step of:
2 reconfiguring the disks into a the more optimal configuration.

1 7. (CURRENTLY AMENDED) A method of selecting a best spare disk for use by a filer
2 in a network storage system including a plurality of filers, and serving an array of disks
3 from a set of spare disks comprising the steps of:

4 selecting one or more disks from the set of spare disks attached to any of the filers
5 of the plurality of filers, said set of disks satisfying one or more hard-coded rules;
6 sorting the one or more disks using a set of ordered-user-selectable policies;
7 if only one disk is highest-ranked, selecting the one disk that is highest-ranked as
8 the best spare disk; and
9 if a plurality of disks are highest-ranked, selecting one of the disks from the plu-
10 rality of disks that are highest-ranked as the best spare disk.

1 8. (CANCELLED)

1 9. (CURRENTLY AMENDED) ~~The network storage system of claim 8, wherein the~~
2 ~~means for allocating one or more of the plurality of spare disks further comprises:~~
3 A network storage system including a plurality of spare disks, comprising:
4 means for identifying the plurality of spare disks, the set of spare disks attached to
5 a plurality of file servers of the network storage system;
6 means for selecting a best spare disk from the plurality of spare disks, the best
7 spare disk chosen according to a plurality of user-selectable policies; and
8 means for claiming ownership of the best spare disk.

1 10. (CURRENTLY AMENDED) The network storage system of claim 9, wherein the
2 means for selecting a best spare disk from the plurality of spare disks further comprises:
3 means for selecting a set of disks from the plurality of spare disks that satisfy one or
4 more hard-coded rules;
5 means for sorting the set of disks according to a set of the plurality of user-selectable
6 ordered policies; and
7 means for selecting a highest-ranked disk from the set of disks.

1 11. (CURRENTLY AMENDED) A computer-readable medium, including program
2 instructions executing on a particular filer, for allocating a replacement disk to the parti-
3 cular filer, the program instructions performing the steps of:
4 identifying a set of spare disks the set of spare disks attached to a plurality of fil-
5 ers of the network storage system;
6 choosing a best spare disk of the set of spare disks the best spare disk attached to
7 any of the plurality of filers, the best spare disk chosen according to a plurality of user-
8 selectable policies; and
9 claiming ownership of the best spare disk.

1 12. (CURRENTLY AMENDED) The computer-readable medium of claim 11, wherein
2 the step of choosing the best spare disk further comprises the steps of:

3 selecting one or more disks from a set of spare disks that satisfy one or more hard-
4 coded rules;

5 sorting the one or more disks selected from the set of spare disks according to a
6 ~~set of ordered~~ the plurality of user-selectable policies to identify a highest-ranked disk;

7 choosing a highest-ranked disk as the best spare disk; and

8 choosing, in response to more than one of the one or more disks being highest-
9 ranked, one disk at random, from the more than one of the one or more disks that are
10 highest-ranked, as the best spare disk.

1 13. (PREVIOUSLY PRESENTED) A method for allocating a spare disk to replace a
2 failed disk in a network storage system, comprising:

3 maintaining a plurality of volumes in the network storage system, each volume
4 associated with a set of disk storage units;

5 maintaining a plurality of spare disks in the network storage system;

6 choosing a best spare disk of the plurality of spare disks to replace a failed disk,
7 the failed disk associated with any volume of the network storage system; and

8 replacing the failed disk with the best spare disk.

1 14. (PREVIOUSLY PRESENTED) The method as in claim 13, further comprising:

2 establishing at least one file server in the network storage system; and

3 performing the step of choosing a best spare disk by the at least one file server.

1 15. (PREVIOUSLY PRESENTED) The method as in claim 13, further comprising:

2 establishing at least one file server in the network storage system; and

3 performing the step of replacing the failed disk with the best spare disk by the file
4 server.

- 1 16. (PREVIOUSLY PRESENTED) The method as in claim 13, further comprising:
 - 2 determining the best spare disk by selecting those disks from the plurality of spare
 - 3 disks which meet at least one selected rule.
- 1 17. (PREVIOUSLY PRESENTED) The method as in claim 13, further comprising:
 - 2 sorting disks in accordance with policies, and assigning a score to each disk as a
 - 3 result of the sorting; and
 - 4 selecting the disk with a highest score as the best spare disk.
- 1 18. (PREVIOUSLY PRESENTED) The method as in claim 13, further comprising:
 - 2 determining those disks of the plurality of spare disks which meet at least one se-
3 lected rule to form a selected pool of disks;
 - 4 sorting disks of the selected pool of disks in accordance with policies, and assign-
5 ing a score to each disk as a result of the sorting; and
 - 6 selecting the disk with a highest score as the best spare disk.
- 1 19. (PREVIOUSLY PRESENTED) The method as in claim 13, further comprising:
 - 2 using a random selection process to select the best spare disk in the event that two
 - 3 or more disks appear to be equally the best spare disk.
- 1 20. (PREVIOUSLY PRESENTED) A method for allocating a spare disk to replace a
2 failed disk in a network storage system, comprising:
 - 3 maintaining a plurality of volumes in the network storage system, each volume
 - 4 associated with a set of disk storage units;
 - 5 maintaining a plurality of spare disks in the network storage system;
 - 6 attempting to determine the best spare disk by selecting those disks from the plu-
7 rality of spare disks which meet at least one rule;
 - 8 replacing the failed disk with the best spare disk;

9 in the event that no spare disk meets the at least one rule, selecting a spare disk
10 which violates the at least one rule as a selected disk; and
11 notifying an administrator that the selected spare disk violates the rule.

1 21. (PREVIOUSLY PRESENTED) A network storage system, comprising:
2 means for maintaining a plurality of volumes in the network storage system, each
3 volume associated with a set of disk storage units;
4 means for maintaining a plurality of spare disks in the network storage system;
5 means for choosing a best spare disk of the plurality of spare disks to replace a
6 failed disk, the failed disk associated with any volume of the network storage system; and
7 means for replacing the failed disk with the best spare disk.

1 22. (PREVIOUSLY PRESENTED) The network storage system of claim 21, further
2 comprising:
3 means for establishing at least one file server in the network storage system; and
4 means for performing the step of choosing a best spare disk by the at least one file
5 server.

1 23. (PREVIOUSLY PRESENTED) The network storage system of claim 21, further
2 comprising:
3 means for establishing at least one file server in the network storage system; and
4 means for performing the step of replacing the failed disk with the best spare disk
5 by the file server.

1 24. (PREVIOUSLY PRESENTED) The network storage system of claim 21, further
2 comprising:
3 means for determining the best spare disk by selecting those disks from the plural-
4 ity of spare disks which meet at least one selected rule.

- 1 25. (PREVIOUSLY PRESENTED) The network storage system of claim 21, further
- 2 comprising:
 - 3 means for sorting disks in accordance with policies, and assigning a score to each
 - 4 disk as a result of the sorting; and
 - 5 means for selecting the disk with a highest score as the best spare disk.
- 1 26. (PREVIOUSLY PRESENTED) The network storage system of claim 21, further
- 2 comprising:
 - 3 means for determining those disks of the plurality of spare disks which meet at
 - 4 least one selected rule to form a selected pool of disks;
 - 5 means for sorting disks of the selected pool of disks in accordance with policies,
 - 6 and assigning a score to each disk as a result of the sorting; and
 - 7 means for selecting the disk with a highest score as the best spare disk.
- 1 27. (PREVIOUSLY PRESENTED) The network storage system of claim 21, further
- 2 comprising:
 - 3 means for using a random selection process to select the best spare disk in the
 - 4 event that two or more disks appear to be equally the best spare disk.
- 1 28. (PREVIOUSLY PRESENTED) A network storage system, comprising:
 - 2 means for maintaining a plurality of volumes in the network storage system, each
 - 3 volume associated with a set of disk storage units;
 - 4 means for maintaining a plurality of spare disks in the network storage system;
 - 5 means for attempting to determine a best spare disk by selecting those disks from
 - 6 the plurality of spare disks which meet at least one rule;
 - 7 means for replacing the failed disk with the best spare disk;
 - 1 in the event that no spare disk meets the at least one rule, means for selecting a
 - 2 spare disk which violates the at least one rule as a selected disk; and
 - 3 means for notifying an administrator that the selected spare disk violates the rule.

1 29. (PREVIOUSLY PRESENTED) A file server in a network storage system, comprising:

3 a storage adapter to connect to a plurality of disk storage units in the network
4 storage system;

5 an operating system to maintain a plurality of volumes, each volume associated
6 with a set of disk storage units, the set of disk storage units selected from the plurality of
7 disk storage units;

8 the operating system maintaining a plurality of spare disks units selected from the
9 plurality of disk storage units;

10 the operating system choosing a best spare disk of the plurality of spare disks to
11 replace a failed disk, the failed disk associated with any volume of the network storage
12 system; and

13 the operating system replacing the failed disk with the best spare disk.

1 30. (PREVIOUSLY PRESENTED) The file server of claim 29, further comprising:

2 the operating system determining the best spare disk by selecting those disks from
3 the plurality of spare disks which meet at least one selected rule.

1 31. (PREVIOUSLY PRESENTED) The file server system of claim 29, further comprising:

3 the operating system sorting disks in accordance with policies, and assigning a
4 score to each disk as a result of the sorting; and

5 the operating system selecting the disk with a highest score as the best spare disk.

1 32. (PREVIOUSLY PRESENTED) The file server system of claim 29, further comprising:

3 the operating system determining those disks of the plurality of spare disks which
4 meet at least one selected rule to form a selected pool of disks;

5 the operating system sorting disks of the selected pool of disks in accordance with
6 policies, and assigning a score to each disk as a result of the sorting;

7 the operating system selecting the disk with a highest score as the best spare disk.

1 33. (PREVIOUSLY PRESENTED) The file server of claim 29, further comprising:
2 the operating system using a random selection process to select the best spare disk
3 in the event that two or more disks appear to be equally the best spare disk.

1 34. (PREVIOUSLY PRESENTED) A file server in a network storage system, comprising:
2

3 a storage adapter to connect to a plurality of disk storage units in the network
4 storage system;

5 an operating system to maintain a plurality of volumes, each volume associated
6 with a set of disk storage units, the set of disk storage units selected from the plurality of
7 disk storage units;

8 the operating system maintaining a plurality of spare disks units selected from the
9 plurality of disk storage units;

10 the operating system choosing a best spare disk of the plurality of spare disks to
11 replace a failed disk, the failed disk associated with any volume of the network storage
12 system;

13 the operating system attempting to determine a best spare disk by selecting those
14 disks from the plurality of spare disks which meet at least one rule;

15 the operating system replacing the failed disk with the best spare disk;

16 in the event that no spare disk meets the at least one rule, the operating system se-
17 lecting a spare disk which violates the at least one rule as a selected disk; and

18 the operating system notifying an administrator that the selected spare disk vio-
19 lates the rule.

1 35. (PREVIOUSLY PRESENTED) A computer readable media, comprising:

2 said computer readable media containing instructions for execution on a processor
3 for the practice of a method for allocating a spare disk to replace a failed disk in a net-
4 work storage system, the method having the steps of,
5 maintaining a plurality of volumes in the network storage system, each volume
6 associated with a set of disk storage units;
7 maintaining a plurality of spare disks in the network storage system;
8 choosing a best spare disk of the plurality of spare disks to replace a failed disk,
9 the failed disk associated with any volume of the network storage system; and
10 replacing the failed disk with the best spare disk.

1 36. (CANCELLED)

1 37. (NEW) The method of claim 13 wherein the best spare disk is chosen based upon
2 physical proximity to the failed disk.

1 38. (NEW) The method of claim 13 wherein the best spare disk is chosen based upon a
2 comparison of the storage space of the spare disks and the failed disk.

1 39. (NEW) The method of claim 13 wherein the best spare disk is chosen based upon a
2 comparison of the speed of the spare disks and the failed disk.

1 40. (NEW) A computer implemented method for allocating a spare storage device to
2 replace a failed storage device in a network storage system, comprising:
3 identifying a set of spare storage devices in the network storage system; and
4 selecting a particular spare storage device of the set of spare storage devices to re-
5 place the failed storage device, the particular spare storage device selected using a prox-
6 imity policy in which preference is given to a spare storage device physically closest to
7 the failed storage in the network storage system.

- 1 41. (NEW) The method of claim 40 wherein the proximity policy gives preference to a
2 spare storage device on a same shelf as the failed storage device.
- 1 42. (NEW) The method of claim 40 wherein the proximity policy gives preference to a
2 spare storage device on a same loop as the failed storage device.
- 1 43. (NEW) The method of claim 40 wherein the proximity policy gives preference to a
2 spare storage device on a same switch as the failed storage device.
- 1 44. (NEW) The method of claim 40 wherein the proximity policy gives preference to a
2 spare storage device on a same switch as the failed storage device.
- 1 45. (NEW) A computer implemented method for allocating a spare storage device to
2 replace a failed storage device in a network storage system, comprising:
 - 3 identifying a set of spare storage devices in the network storage system; and
 - 4 selecting a particular spare storage device of the set of spare storage devices to re-
 - 5 place the failed storage device, the particular spare storage device selected using a size
 - 6 policy in which preference is given to a spare storage device with minimum storage space
 - 7 in excess of the storage space of the failed disk.
- 1 46. (NEW) A computer implemented method for allocating a spare storage device to
2 replace a failed storage device in a network storage system, comprising:
 - 3 identifying a set of spare storage devices in the network storage system; and
 - 4 selecting a best spare storage device of the set of spare storage devices to replace
 - 5 the failed storage device, the best spare storage device selected using a speed policy in
 - 6 which preference is given to a spare storage device with a speed closest to that of the
 - 7 failed disk.

- 1 47. (NEW) The method of claim 46 wherein the speed is a rotation speed.
- 1 48. (NEW) The method of claim 46 wherein the speed is a data read speed.
- 1 49. (NEW) The method of claim 46 wherein the speed is a data write speed.
- 1 50. (NEW) A computer readable medium comprising executable program instructions
2 for allocating a spare storage device to replace a failed storage device in a network stor-
3 age system, the executable program instructions adapted for:
 - 4 identifying a set of spare storage devices in the network storage system; and
 - 5 selecting a particular spare storage device of the set of spare storage devices to re-
6 place the failed storage device, the particular spare storage device selected using a prox-
7 imity policy in which preference is given to a spare storage device physically closest to
8 the failed storage in the network storage system.
- 1 51. (NEW) A computer readable medium comprising executable program instructions
2 for allocating a spare storage device to replace a failed storage device in a network stor-
3 age system, the executable program instructions adapted for:
 - 4 identifying a set of spare storage devices in the network storage system; and
 - 5 selecting a particular spare storage device of the set of spare storage devices to re-
6 place the failed storage device, the particular spare storage device selected using a size
7 policy in which preference is given to a spare storage device with minimum storage space
8 in excess of the storage space of the failed disk.
- 1 52. (NEW) A computer readable medium comprising executable program instructions
2 for allocating a spare storage device to replace a failed storage device in a network stor-
3 age system, the executable program instructions adapted for:
 - 4 identifying a set of spare storage devices in the network storage system; and

5 selecting a best spare storage device of the set of spare storage devices to replace
6 the failed storage device, the best spare storage device selected using a speed policy in
7 which preference is given to a spare storage device with a speed closest to that of the
8 failed disk.